Preface

The title adaptive modeling and simulation (ADMOS) describes a large research field in Computational Mechanics. The paradigm of adaptivity has changed in the last decade, including now a wider spectrum of methodologies and applications. Leading edge researchers are now pushing forward a front advancing in different complementary directions.

The early work in adaptivity focused mainly on estimating and controlling the error in the energy norm. Moreover, the accuracy of the numerical solution was considered to be related only with the mesh and the modeling error associated with the selected physical model was not accounted for. Finally, the application examples were restricted to a few model problems. Presently, these three limits have been overcome by the goal-oriented adaptive philosophy, the validation techniques, which assess and control the accuracy of the model itself, and the extension of adaptive procedures to practical engineering problems.

This is demonstrated by the papers included in this Special Issue, collecting some of the keynote contributions to the first ADMOS conference, held at Chalmers University of Technology (Goteborg, Sweden) in September 2003. The opening talk of the conference was a state-of-the-art review and prospective of the research on error estimation and adaptivity by O.C. Zienkiewicz: this talk was the seed of the paper opening this issue. In the same line, the paper by G. Carey presents a detailed analysis of the current advances in Adaptive Modeling and Meshing. The paper discusses the assessment of the error coming from both the discretization and the modeling that is covering the topics of verification and validation. Validation is in fact the topic of the three papers in the Issue presented by P. Ladevèze, K. Runesson and Ph. Bouillard.

The energy norm is not anymore the only available error measure in a posteriori error estimation. Using the pioneering ideas of Babuška and Miller (1984) a lot of work has been produced on estimating the error in arbitrary quantities of interest, described by functional outputs of the solution. Furthermore, the error estimates have been developed to ensure they provide safe upper and lower bounds of the output error. Six of the papers of this issue are concerned with these techniques, namely the contributions presented by E. Stein, J.P. Moitinho de Almeida, J. Peraire, G. Bugeda, A. Huerta and P. Díez.

The rest of the papers, a total of four, are extending the field of application of adaptivity to complex practical engineering problems. In these works, both the physical and numerical modeling deserve special attention and require a particular accommodation of the adaptive techniques. Moreover, simple and straightforward new error assessment techniques are also developed in order to obtain a feasible adaptive tool for such complex problems. These papers are presented by B.A. Schrefler, H. Mang, E. Oñate and N.-E. Wiberg.

This grand total of 15 papers is a sample that demonstrates the diversity and the strength of the research activity in the topic of adaptive modeling and simulation. We hope that the interest of the topic will be reflected in the success of the next edition of the ADMOS conference, to be held at Barcelona in September 2005.

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